RadioShack®

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Flashing LED Light Display Project Kit

Owner's Manual

Please read before using this equipment.

❒ *Introduction*

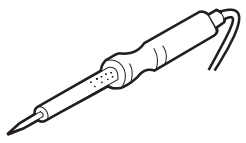
Your RadioShack Flashing LED Light Display Project Kit is a challenging and fun introduction to component-level electronics. Your easy-to-assemble kit includes all the parts you need to build a flashing light which will attract attention and showcase your electronics skills.

The light has 31 light-emitting diodes (LEDs), which display various patterns when you turn it on. Easy and fun to build, your light's case is constructed of durable ABS plastic, making it rugged enough to use every day. The light's push-button power switch lets you turn it on or off.

TOOLS LIST

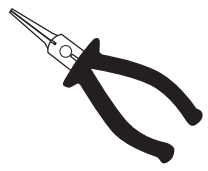
You will need the following tools and supplies (not supplied) to build and operate this kit.

- Soldering Iron



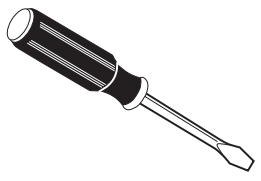
- Rosin-core solder

- Long Nose Pliers

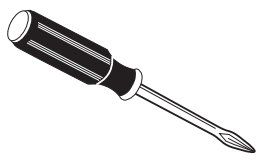


- Diagonal Cutter

- Flat Screwdriver



- Phillips Screwdriver



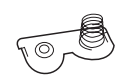
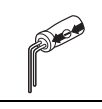
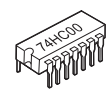
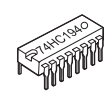
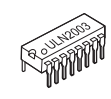
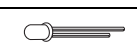
- Two AA Batteries

PARTS LIST

Your kit includes the following parts. Make sure all of these parts are included in your kit as you build it. If any parts are missing, return the kit to your local RadioShack store.

Important: The parts and PCBs (printed circuit boards) are packed in three bags. One bag contains the control PCB and its parts, one contains the LED PCB and its parts, and another contains additional parts such as the power switch, battery terminals, and wires. To avoid mixing parts, open the parts bag containing the control PCB and mount the parts contained in the bag onto the control PCB, open the parts bag containing the LED PCB and mount the parts contained in the bag onto the LED PCB, then open the remaining bag and mount those parts. Check off each part from the parts list below as you open the parts bags.

Electronic Parts

Part Number	Description	Quantity	Illustration (not to scale)
	Battery contact, twin terminal	1	
	Battery contact, negative terminal	1	
	Battery contact, positive terminal	1	
C4	Capacitor, electrolytic, 47µF/16V	1	
C1, C2, C3, C6	Capacitor, ceramic, 104Z/25V	4	
C5	Capacitor, electrolytic, 10µF/25V	1	
U1	IC, 74HC00	1	
U2	IC, 74HC194	1	
U3	IC, ULN2003	1	
D1	LED	31	

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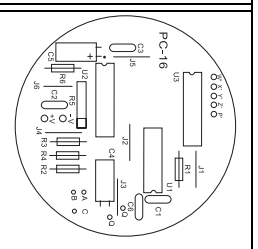
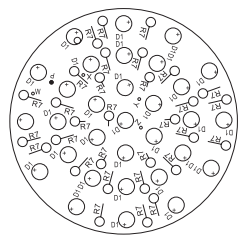
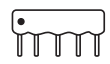
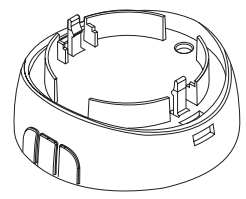
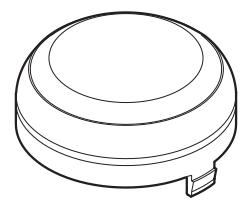
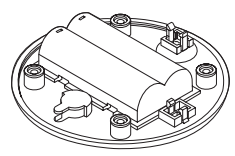
Electronic Parts

Part Number	Description	Quantity	Illustration (not to scale)
PC-16	PCB, control	1	
PC-14	PCB, LED	1	
R1	Resistor, 470 kOhm, 1/4W yellow violet yellow gold	1	
R2, R3	Resistor, 100 kOhm, 1/4W brown black yellow gold	2	
R4	Resistor, 56 kOhm, 1/4W green blue orange gold	1	
R5	Resistor pack, 100 kOhm, 1/8W	1	
R6	Resistor, 1 kOhm, 1/4W brown black red gold	1	
R7	Resistor, 330 Ohm, 1/4W orange orange brown gold	31	
	DIP switch	1	

Electronic Parts

Part Number	Description	Quantity	Illustration (not to scale)
	Power switch	1	
	Wire,24AWG; short black (1) short gray (1) short orange (1) short red (1) short white (1) short yellow (1) long black (1) long green (1) long orange (2) long red (1) long white (1) long yellow (1)	13	
	Wire, jumper	6	

Mechanical Parts

Part Number	Description	Quantity	Illustration (not to scale)
	Base	1	
	Dome	1	
	Bottom cover	1	
	Screw, 3 mm × 10 mm	4	
	Support post	4	

HOW DOES THE KIT WORK?

What Do the ICs Do?

Your kit contains three integrated circuits (ICs). ICs have a variety of different applications, depending on where they are used.

In your kit, U1 (74HC00) is an IC that sends a clock signal to U2 (74HC194). U2 is a controller IC (called a *binary shift register*) that regulates the direction in which the LEDs light. U3 (ULN2003) is a Darlington transistor array that drives enough current to keep the LEDs lit.

When you assemble the kit then turn it on, U1's pins 8 and 11 provide an input to U2's pins S0 and S1. You use the kit's DIP switch to adjust the voltage at U2's pins S0 and S1. Setting the DIP switch's pin 1 to ON and pin 2 to OFF causes U2's S0 voltage to be increased, making the LEDs flash in concentric circles from the inside to the outside. Setting the DIP switch's pin 2 to ON and pin 1 to OFF causes U2's S1 voltage to be increased, making the LEDs flash in concentric circles from the outside to the inside.

The kit's LEDs flash according to U2's pin voltage changes as follows:

Pin 15/QA Voltage	Pin 14/QB Voltage	Pin 13/QC Voltage	Pin 12/QD Voltage	LEDs Light
High	Low	Low	Low	1 (outer circle)
Low	High	Low	Low	2
Low	Low	High	Low	3
Low	Low	Low	High	4 (inner circle)

R4 and C4 receive voltage from the batteries then pass it onto U1, which passes it to its pins 10 and 13, causing the LEDs to light.

The rate at which the LEDs flash depends on the voltage of R1 and the rate at which C1 charges and discharges. When R4 has low voltage and C4 discharges, the LEDs do not light.

What Do the Capacitors Do?

Your kit contains six capacitors. Capacitors are used to temporarily store an electrical charge or filter (smooth out) pulsating signals. Capacitors can also pass alternating current (AC) signals while blocking direct current (DC) signals.

In your kit, C1, C2, C3, and C6 are 0.1µF ceramic capacitors (shaped like a round disk), C5 is a 10µF 25V electrolytic capacitor (shaped like a cylinder), and C4 is a 47µF 16V electrolytic capacitor. (shaped like a cylinder).

Important: Electrolytic capacitors are marked to show their negative (–) side. Ceramic capacitors do not have a positive or negative side; you can connect the sides interchangeably. As you build the kit, be sure to connect the negative side of electrolytic capacitors correctly. You can connect ceramic capacitors in either direction.

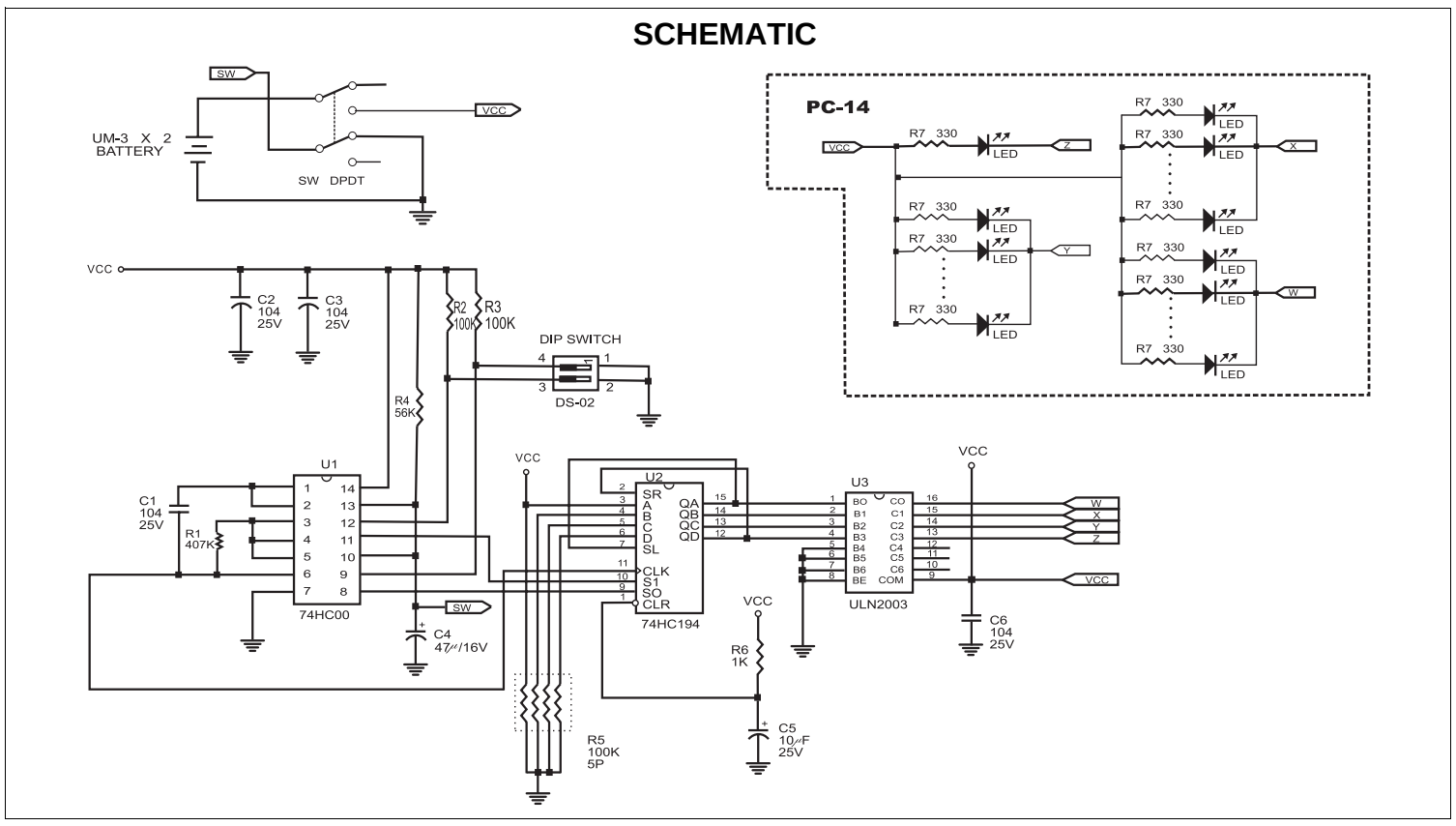
What Do the Resistors Do?

Your kit contains 36 resistors. Resistors oppose the flow of electrons, limiting the amount of current flowing through a circuit. They are used in electronic circuits to adjust the amount of voltage supplied to other components. You can connect resistors in either direction.

In your kit, R1 is a 470k ohm resistor, R2 and R3 are 100k ohm resistors, R4 is a 56k ohm resistor, R6 is a 1k ohm resistor, and R7 are 330 ohm resistors. R5 is a 100k ohm resistor pack which combines four 100k regular resistors in an array and uses a common pin (the one with a round dot above it) to save space.

A resistor's ohm value shows how strongly that resistor will oppose a flow of electrons.

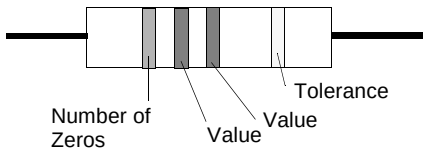
SCHEMATIC



All of the resistors in your kit except R5 are brown and shaped like a cylinder with color bands around it. The following table shows color bands showing the resistor's value in ohms and the value each band represents as follows:

Color	Value (in ohms)	Color	Value (in ohms)
Black	0	Green	5
Brown	1	Blue	6
Red	2	Violet	7
Orange	3	Gray	8
Yellow	4	White	9

To determine a resistor’s value, hold it with the gold or silver band to the right.



The band on the right shows the resistor’s *tolerance* (the degree of accuracy of the resistance shown). A gold band indicates that the resistor is within 5% of the resistance shown. A silver band indicates that the resistor is within 10% of the resistance shown.

The two bands to the left of the tolerance band show the resistor’s *value*, from left to right. For example, if the bands are red and orange, the resistor’s value is 23. The band on the left of the resistor shows the number of zeros after the value. For example, if the band is yellow, the number of zeros is 4. Therefore, the resistor is 230,000 ohms.

The values of resistors are usually abbreviated by using the letter K to symbolize 1,000 ohms and the letter M (or Meg) to symbolize 1,000,000 ohms. For example, a 4.7k ohm resistor has a resistance of 4,700 ohms.

SOLDERING TIPS

To assemble this kit, you must solder connections and components. Use a low-wattage soldering iron to assemble the kit. Soldering irons, solder, and soldering supplies are all available at your local RadioShack store.

Warning: Do not touch the tip of a soldering iron while it is plugged in, nor allow the hot tip to touch any object other than the item you are soldering.

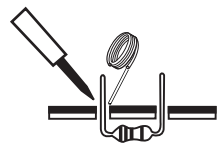
Caution: Do not let a hot soldering iron rest on a tabletop or any other surface. Place the soldering iron’s hot tip on a soldering iron rest (available at your local RadioShack store) while you are not actually soldering.

Use these tips to help you solder more easily and efficiently.

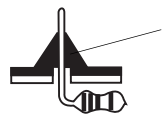
- Always tin the tip of a soldering iron before you use it and during extended use.
- Always use rosin core solder for electronics components.
- Use a damp sponge to occasionally wipe your soldering iron’s tip to remove debris.
- Unplug your soldering iron when not in use.

Follow these steps to solder a connection.

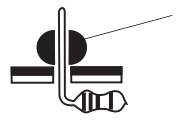
1. Plug your soldering iron into a standard AC outlet, then allow it to heat for at least 10 minutes.
2. Use the hot tip of the soldering iron to heat the connection, *not the solder*.



3. While holding the tip of the soldering iron in place, hold the end of the roll of solder onto the connection from the opposite side of the connection as the soldering iron. Allow the solder to flow around the component on the circuit board **and** onto the *land* on the circuit board (the thin metal strip through which the component is mounted). Then pull the roll of solder back, remove the soldering iron, and allow the connection to cool. Do not apply too much solder or move the connection as it cools.



Example of correct solder joint (solder covers both component and land)



Example of incorrect solder joint (solder only covers component; no connection to land)

❒ *Assembly*

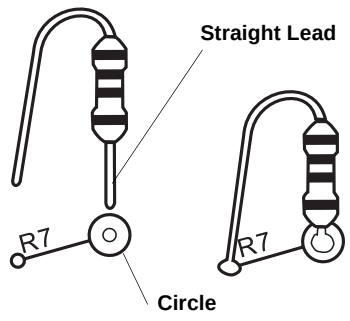
ASSEMBLING THE LED PCB

There are 31 resistors and 31 LEDs that you must mount on the LED PCB (marked PC-14 on its pattern side (the side with the lands)). Insert the parts on the PCB’s top side (the side printed with part numbers or symbols).

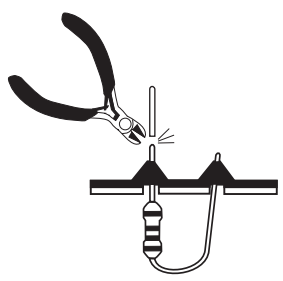
Important: Due to the limited space in your kit, you must mount the resistors perpendicular to the PCB as shown in the illustration by Step 2. Do not mount the resistors flat on the PCB.

Follow these steps to assemble the LED PCB.

1. Mount an R7 resistor on the PCB by bending it as shown here, then inserting both ends into a pair of holes marked R7 on the PCB. For each resistor, be sure to insert the straight lead into the hole surrounded by a large circle on the PCB as shown here.



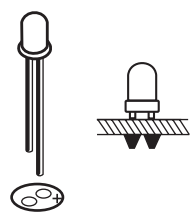
2. While using a diagonal cutter to hold the resistor perpendicular to the PCB, solder the resistor's two leads onto the PCB's pattern side, then use the diagonal cutter to trim any extra lead on the PCB's pattern side.



3. Repeat Steps 1 and 2 for each R7 resistor.

Important: LEDs will work only if mounted with the correct *polarity* (with the LED's longer lead inserted into the hole marked +). If you mount an LED incorrectly, it will not work.

4. Mount a D1 LED on the PCB by inserting both leads into a pair of holes marked D1 on the PCB. Insert the LED's longer lead into the hole marked + and the shorter lead into the other hole.



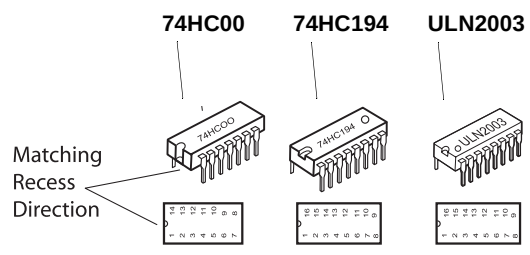
5. Solder the LED's two leads onto the PCB's pattern side as shown here, then use a diagonal cutter to trim any extra lead on the PCB's pattern side.

6. Repeat Steps 4 and 5 for each D1 LED.

ASSEMBLING THE CONTROL PCB

There are three ICs, six jumper wires, six capacitors, and six resistors that you must mount on the control PCB (marked PC-16 on its pattern side). Insert the parts on the PCB's top side.

Mounting ICs



Tip: The small numbers inside the boxes in the above illustration are called *pinouts*. Pinouts are an easy way to show what is connected to each lead of each IC. The pinout numbers shown here each have a corresponding number on the schematic on Page 4.

Important:

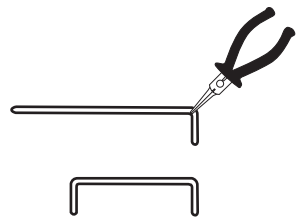
- Although you might have to carefully bend one or more of the legs on the ICs to insert them into the holes on the PCB, never bend them unnecessarily.
- Some ICs are sensitive to static electricity and heat and can be damaged if you touch them without first grounding yourself or apply heat from a soldering iron to them for too long. Never touch the legs of or apply heat to any IC more than necessary to mount it, or unnecessarily expose an IC to electricity.
- Make sure each of the IC's legs goes through its designated hole on the PCB before you solder it onto the PCB.
- U1 faces a different direction than U2 and U3 on the PCB. Be sure to mount all ICs in the direction indicated on the PCB.

Follow these steps to mount the ICs.

1. Mount the U1 IC on the PCB by inserting each of its legs into the group of holes marked U1 on the PCB. Make sure the recess on the IC is facing the same direction as the recess marked on the PCB.
2. Solder all of the IC's leads onto the PCB's pattern side.
3. Repeat Steps 1 and 2 for the U2 and U3 ICs.

Mounting Jumper Wires

1. Mount the J1 jumper wire on the PCB by bending it, then inserting both ends into the pair of holes marked J1 on the PCB.

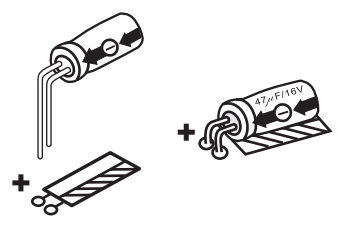


2. Solder both of the jumper wire's ends onto the PCB's pattern side, then use a diagonal cutter to trim any extra jumper wire on the PCB's pattern side.
3. Repeat Steps 1 and 2 for the J2, J3, J4, J5, and J6 jumper wires.

Mounting Capacitors

Important: Electrolytic capacitors will work only if mounted with the correct *polarity* (with the capacitor's longer lead inserted into the hole marked + and its lead marked – into the other hole). If you mount an electrolytic capacitor incorrectly, it will not work.

1. Mount the C4 electrolytic capacitor on the PCB by bending it, then inserting both leads into the pair of holes marked C4 on the PCB. Insert the capacitor's longer lead into the hole marked + and the capacitor's shorter lead (marked –) into the hole next to the one marked +

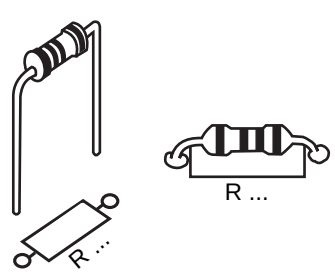


2. Solder the capacitor's two leads onto the PCB's pattern side, then use a diagonal cutter to trim any extra lead on the PCB's pattern side.
3. Repeat Steps 1 and 2 for the C5 electrolytic capacitor.
4. Mount the C1 ceramic capacitor on the PCB by inserting both leads into the pair of holes marked C1 on the PCB.

   Note: Ceramic capacitors have no *polarity* (neither of its leads are designated as positive or negative). You can mount its leads in either direction in the holes.
5. Solder the capacitor's two leads onto the PCB's pattern side, then use a diagonal cutter to trim any extra lead on the PCB's pattern side.
6. Repeat Steps 4 and 5 for the C2, C3, and C6 ceramic capacitors.

Mounting Resistors

1. Mount the R1 resistor on the PCB by bending it then inserting both ends into the pair of holes marked R1 on the PCB.



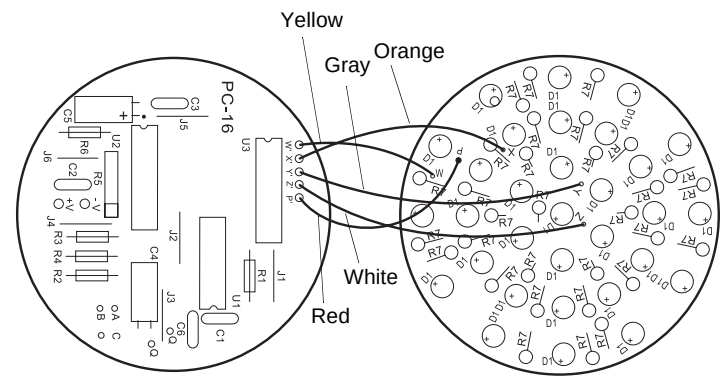
2. Solder the resistor's two leads onto the PCB's pattern side, then use a diagonal cutter to trim any extra lead on the PCB's pattern side.

3. Repeat Steps 1 and 2 for the R2, R3, R4, and R6 resistors.

4. Mount the R5 resistor on the PCB by inserting each of its legs into the group of holes marked R5 on the PCB. Make sure to insert the pin marked by the round dot (common pin) on the resistor into the hole surrounded by a box on the PCB.

5. Solder all of the resistor's leads onto the PCB's pattern side, then use a diagonal cutter to trim any extra leads on the PCB's pattern side.

CONNECTING THE LED PCB TO THE CONTROL PCB



There are five wires that connect the LED PCB to the control PCB. Connecting these wires lets the control PCB operate the LED PCB.

Insert the wires through both PCB's top sides which are printed with terminal letters as shown here. The terminal letters are marked W, X, Y, Z, and P on the LED PCB and W', X', Y', Z', and P' on the control PCB.

Note: Your kit includes two sets of colored wires. Use the shorter set of wires to connect these PCBs.

Follow these steps to connect the LED PCB to the control PCB.

1. Insert one end of the yellow wire into the hole marked W on the LED PCB.

2. Solder the wire's end onto the PCB's pattern side, then use a diagonal cutter to trim any extra lead on the PCB's pattern side.

3. Insert the other end of the yellow wire into the hole marked W' on the control PCB.

4. Solder the wire's end onto the PCB's pattern side, then use a diagonal cutter to trim any extra leads on the PCB's pattern side.

5. Repeat Steps 1–4 for each additional wire, using the following table as a guide.

Wire Color	Holes Marked
Orange	X and X'
Gray	Y and Y'
White	Z and Z'
Red	P and P'

MOUNTING THE DIP SWITCH AND POWER SWITCH ON THE BOTTOM COVER

1. Turn the bottom cover so the label for the DIP switch (next to the DIP switch socket) on the bottom cover is facing you.

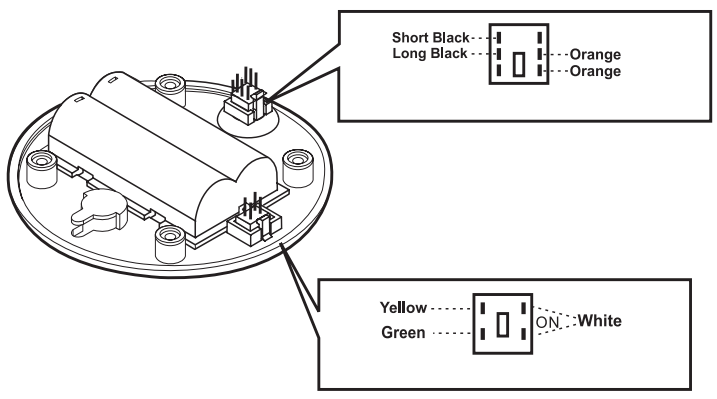
2. Hold the DIP switch and position it so the labels on the switch are facing the same direction as the labels on the bottom cover.

3. Press the DIP switch down from the opposite side of the bottom cover into the DIP switch socket until it clicks into place.

4. Hold the bottom cover so the label for the power switch (next to the power switch socket) on the bottom cover is facing you.

5. Hold the power switch and position it so the side with the square slot (on the bottom) faces right.

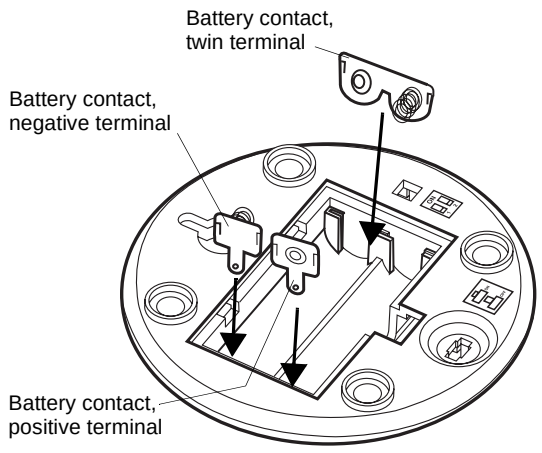
6. Press the power switch down from the opposite side of the bottom cover into the power switch socket until it clicks into place.



7. Route all the remaining wires down through the round hole in the top of the base, into the inside of the base.

MOUNTING THE BATTERY TERMINALS

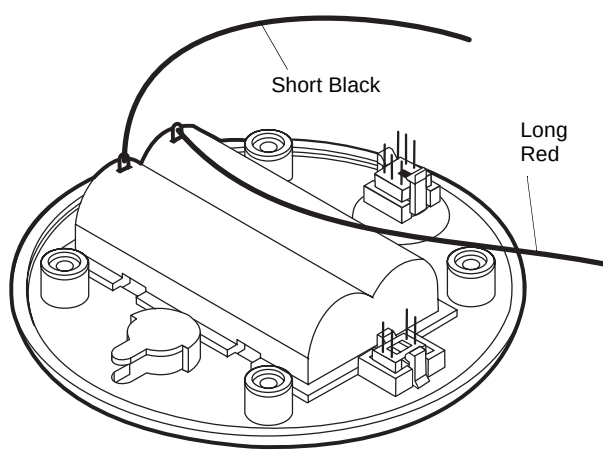
There are three battery terminals that connect the batteries in the battery compartment to the rest of the kit.



Follow these steps to install the battery terminals.

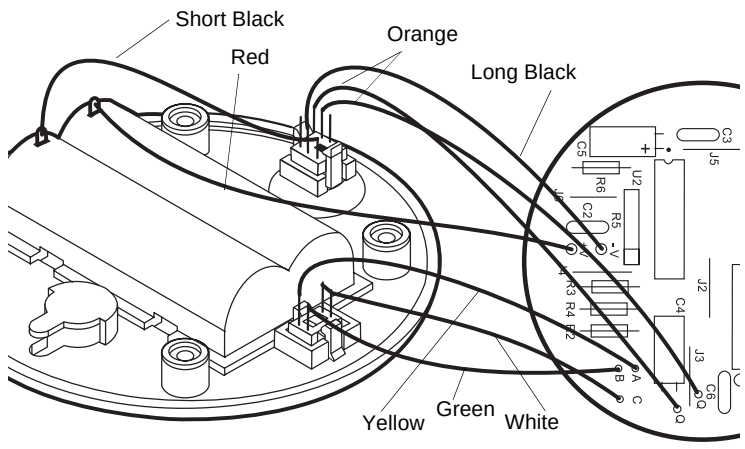
1. Hold the battery contact, positive terminal so its round contact dot faces inside and its terminal pin faces down.
2. Press the terminal into its slot in the bottom cover as shown above, then use a flat screwdriver to press it securely into the slot.
3. Hold the battery contact, negative terminal so its spring faces inside and its terminal pin faces down.
4. Press the terminal into its slot in the bottom cover as shown above, then use a flat screwdriver to press it securely into the slot.
5. Hold the battery contact, twin terminal so its flat side faces up as shown above and its spring faces inside.
6. Press the terminal into its slot in the bottom cover as shown above, then use a flat screwdriver to press it securely into the slot.

Connecting Wires to the Battery Terminals



1. Solder one end of the long red wire to the positive battery terminal pin.
2. Solder one end of the short black wire to the negative battery terminal pin.

FINAL CONNECTIONS



There are seven wires that connect the DIP switch and power switch to the control PCB. Connecting these wires lets the switches control the light.

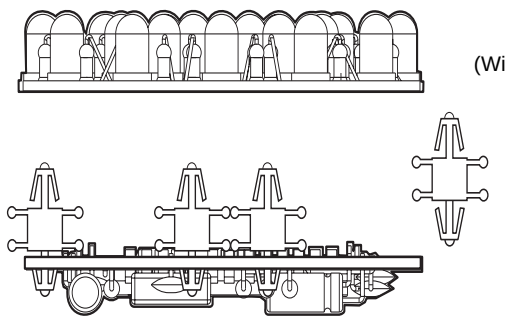
Insert the wires through the control PCB's top side which is printed with terminal letters as shown above. The terminal letters are marked A, B, Q (2), C, +V, and –V.

Tip: To make it easier to solder the wires in the right places, turn the base and control PCB so it appears as shown above, then use the illustration to help you find the right connections before you solder them.

Follow these steps to connect the remaining wires to the PCBs, DIP switch, and power switch.

1. Solder one end of the white wire into the hole marked C on the control PCB, then solder the other end onto both the upper left and right pins on the DIP switch.
2. Solder one end of the green wire into the hole marked B on the control PCB, then solder the other end onto the lower right pin on the DIP switch.
3. Solder one end of the yellow wire into the hole marked A on the control PCB, then solder the other end onto the lower left pin on the DIP switch.
4. Solder one end of one of the orange wires into one of the holes marked Q on the control PCB, then solder the other end onto the upper center pin on the power switch.
5. Solder one end of the other orange wire into the other hole marked Q on the control PCB, then solder the other end onto the upper left pin on the power switch.
6. Solder the other end of the red wire connected to the positive battery terminal pin into the hole marked +V on the control PCB.
7. Solder one end of the long black wire into the hole marked –V on the control PCB, then solder the other end onto the lower center pin on the power switch.
8. Solder the other end of the short black wire connected to the negative battery terminal pin onto the lower right pin on the power switch.

FINAL ASSEMBLY



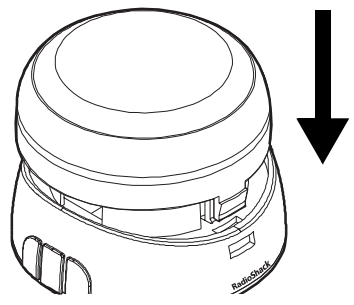
(Wires not shown for clarity)

Important:

- Be very careful when you press the support posts onto the PCBs. The PCBs might be damaged if subjected to rough treatment.
- Make sure the side posts on the support posts rest flat on the PCBs in the space allotted.

Follow these steps to finish your project.

1. Carefully press a support post through each mounting hole on the pattern side of the control PCB.
2. Gently press the ceramic capacitors down against the control PCB. This provides more room on both boards during final assembly.
3. While holding both PCBs so their pattern sides face each other, align the mounting holes on both PCBs.
4. Carefully press the other side of each support post through the mounting holes in the LED PCB.
5. Insert the control PCB and LED PCB assembly into the top of the base.
6. Pull any exposed wires on the bottom of the assembly down through the wire hole.
7. Carefully wrap any extra wire around inside the base so it does not get caught between the dome and the base.
8. Gently press the assembly down onto the base until it clicks into place.
9. Turn the base and bottom cover upside down, then align the four mounting holes on both. Make sure not to trap any of the wires between the mounting holes for the base and the bottom cover.
10. Use the supplied screws and a Phillips screwdriver to attach the bottom cover to the base.
11. Align the dome's latches with their matching slots on the base, then gently press the dome down until it clicks to secure it.



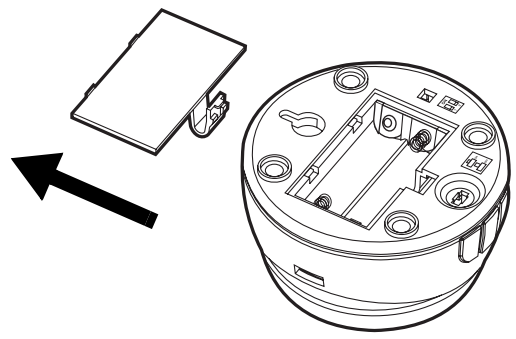
INSTALLING BATTERIES

Your kit requires two AA batteries (not supplied) for power. For the best performance and longest life, we recommend RadioShack alkaline batteries.

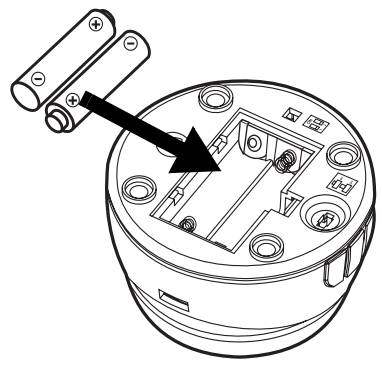
Cautions:

- Use only fresh batteries of the required size and recommended type.
- Do not mix old and new batteries, different types of batteries (standard, alkaline, or rechargeable), or rechargeable batteries of different capacities.

1. While lifting the latch on the battery compartment door, pull up the door to remove it.



2. Place the batteries in the compartment as indicated by the polarity symbols (+ and –) marked inside.



3. Replace the battery compartment door.

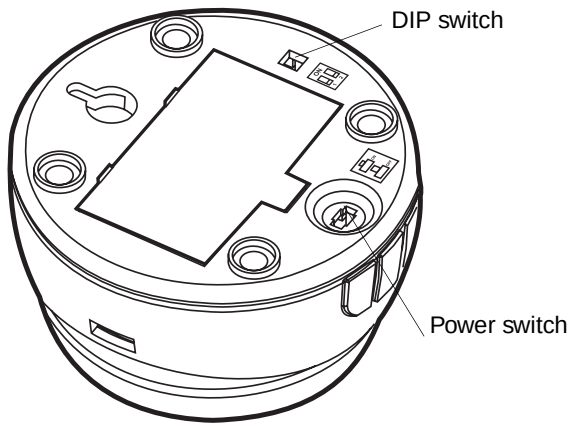
When the light stops flashing or the kit stops operating properly, replace the batteries.

Warning: Dispose of old batteries promptly and properly. Do not burn or bury them.

Caution: If you do not plan to use the kit for a month or more, remove the batteries. Batteries can leak chemicals that can destroy electronic parts.

❒ Operation

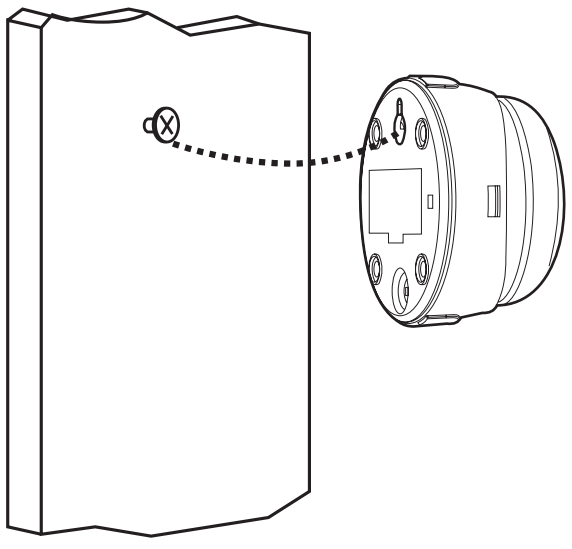
1. Press the power switch until it clicks and stays in to turn the kit on.



2. To make the LEDs flash in concentric circles from the inside to the outside, set the DIP switch's pin 1 to ON and pin 2 to OFF. To make the LEDs flash in concentric circles from the outside to the inside, set the DIP switch's pin 1 to OFF and pin 2 to ON. To make one row of LEDs light, set both DIP switch's pins to OFF or ON.

3. To turn off the kit, press the power switch until it clicks and stays out.

MOUNTING THE KIT



You can place the kit on a desk, shelf, or table, or mount it on a wall.

To mount the kit directly on a wall, you need a screw (not supplied) with a head that fits into the keyhole slot on the bottom of the kit.

Follow these steps to mount the kit on a wall.

1. Drill a hole in the wall. Then thread a screw into the hole, letting the head extend about $^{3}/_{16}$ inch (5 mm) from the wall.

2. Align the base's keyhole slot with the mounting screw and slide the kit downward to secure it.

CARE

Keep the kit dry; if it gets wet, wipe it dry immediately. Use and store the kit only in normal temperature environments. Handle the kit carefully; do not drop it. Keep the kit away from dust and dirt, and wipe it with a damp cloth occasionally to keep it looking new.

Modifying or tampering with the kit's internal components can cause a malfunction and might invalidate its warranty. If your kit is not performing as it should, take it to your local RadioShack store for assistance.

❒ *Notes*

Limited Ninety-Day Warranty

This product is warranted by RadioShack against manufacturing defects in material and workmanship under normal use for ninety (90) days from the date of purchase from RadioShack company-owned stores and authorized RadioShack franchisees and dealers. EXCEPT AS PROVIDED HEREIN, RadioShack MAKES NO EXPRESS WARRANTIES AND ANY IMPLIED WARRANTIES, INCLUDING THOSE OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE DURATION OF THE WRITTEN LIMITED WARRANTIES CONTAINED HEREIN. EXCEPT AS PROVIDED HEREIN, RadioShack SHALL HAVE NO LIABILITY OR RESPONSIBILITY TO CUSTOMER OR ANY OTHER PERSON OR ENTITY WITH RESPECT TO ANY LIABILITY, LOSS OR DAMAGE CAUSED DIRECTLY OR INDIRECTLY BY USE OR PERFORMANCE OF THE PRODUCT OR ARISING OUT OF ANY BREACH OF THIS WARRANTY, INCLUDING, BUT NOT LIMITED TO, ANY DAMAGES RESULTING FROM INCONVENIENCE, LOSS OF TIME, DATA, PROPERTY, REVENUE, OR PROFIT OR ANY INDIRECT, SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, EVEN IF RadioShack HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

Some states do not allow limitations on how long an implied warranty lasts or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

In the event of a product defect during the warranty period, take the product and the RadioShack sales receipt as proof of purchase date to any RadioShack store. RadioShack will, at its option, unless otherwise provided by law: (a) correct the defect by product repair without charge for parts and labor; (b) replace the product with one of the same or similar design; or (c) refund the purchase price. All replaced parts and products, and products on which a refund is made, become the property of RadioShack. New or reconditioned parts and products may be used in the performance of warranty service. Repaired or replaced parts and products are warranted for the remainder of the original warranty period. You will be charged for repair or replacement of the product made after the expiration of the warranty period.

This warranty does not cover: (a) damage or failure caused by or attributable to acts of God, abuse, accident, misuse, improper or abnormal usage, failure to follow instructions, improper installation or maintenance, alteration, lightning or other incidence of excess voltage or current; (b) any repairs other than those provided by a RadioShack Authorized Service Facility; (c) consumables such as fuses or batteries; (d) cosmetic damage; (e) transportation, shipping or insurance costs; or (f) costs of product removal, installation, set-up service adjustment or reinstallation.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

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